

Effects of Wearable Device-Based Physical Activity Intervention on Sedentary Behavior and Cardiovascular Risk Factors Among Office Workers

Minghao Li¹ & Xiao Wu¹

¹ Chongqing Medical University, Chongqing, China

Correspondence: Minghao Li, Chongqing Medical University, Chongqing, China.

doi:10.56397/SSSPE.2025.03.02

Abstract

Prolonged sedentary behavior among office workers poses significant health risks, including cardiovascular disease and metabolic disorders. In China, the rapid expansion of corporate and technology sectors has exacerbated these issues, leading to increased hypertension, obesity, and insulin resistance. Wearable device-based interventions help mitigate sedentary time through real-time movement tracking, activity reminders, and personalized goal-setting. Research indicates that such interventions can reduce sedentary time by 25–40%, increase daily steps by 2,500–3,500, and improve blood pressure, insulin sensitivity, and lipid profiles. Long-term use is associated with a 30% lower risk of cardiovascular disease and enhanced workplace productivity. However, challenges such as adherence decline, data accuracy concerns, workplace movement restrictions, and privacy issues persist. Future research should explore AI-driven adaptive goal-setting, behavioral reinforcement, and social motivation strategies, alongside corporate policies that promote active office environments. With advancements in sensor technology and digital health integration, wearable devices can play a crucial role in cardiovascular health management and workplace wellness.

Keywords: sedentary behavior, wearable devices, physical activity intervention, cardiovascular health, workplace wellness, blood pressure regulation

1. Introduction

With the rapid economic growth and evolving workplace culture in China, sedentary behavior has become a major public health concern, particularly among office workers who spend extended hours sitting at desks with minimal physical activity. The increasing reliance on digital technology, long working hours, and high job demands have contributed to excessive sitting time in Chinese workplaces, posing significant risks to employee health. Studies

have consistently linked prolonged sedentary behavior with an increased risk of cardiovascular disease (CVD), obesity, type 2 diabetes, and premature mortality. According to the China CDC's Chronic Disease Surveillance Report (2021), over 60% of Chinese office workers sit for more than 8 hours per day, making sedentary behavior a serious health challenge.

The workplace serves as a critical setting for sedentary behavior, as Chinese office workers

often work under intensive schedules, high job competition, and extended overtime hours. A 2022 study published in the Chinese Journal of Preventive Medicine found that employees in industries such as finance, IT, and corporate management had the highest sedentary time, with some exceeding 10 hours per day. This prolonged sitting is associated with poor metabolic health, elevated blood pressure, reduced cardiovascular fitness, and increased risks of musculoskeletal disorders. While interventions such as standing desks, workplace movement policies, and government-driven fitness campaigns (e.g., the “Healthy China 2030” initiative) have been introduced, compliance remains low due to workplace culture, time constraints, and a lack of effective engagement strategies. This highlights the need for personalized, technology-driven interventions to promote physical activity among office workers.

Wearable devices have emerged as a promising intervention tool for addressing sedentary lifestyles in China. With the increasing popularity of smartwatches, fitness bands, and health tracking applications from brands such as Huawei, Xiaomi, and OPPO, more individuals are using these devices to monitor their physical activity levels, heart rate, and movement patterns. These wearables provide real-time feedback, personalized activity reminders, and behavioral reinforcement mechanisms, encouraging users to reduce sedentary time and engage in more frequent physical movement throughout the workday. Unlike traditional health interventions, wearable technology offers a data-driven, interactive approach that aligns with China’s growing digital health ecosystem.

Research has shown that wearable-based interventions can significantly impact physical activity behavior. A 2023 study conducted by Tsinghua University’s Department of Public Health found that Chinese office workers who used fitness trackers increased their daily step count by an average of 2,500 to 4,000 steps, translating to a 25-35% reduction in sedentary time. Additionally, corporate wellness programs integrating wearable-based activity tracking have been linked to lower blood pressure, improved glucose metabolism, and better cardiovascular health outcomes. A 2022 report from the China National Health Commission revealed that companies implementing wearable-assisted workplace fitness programs

observed a 15% reduction in employee absenteeism and a 20% increase in reported workplace productivity.

Despite these promising results, long-term adherence, engagement, and effectiveness of wearable interventions in workplace settings remain challenges. Factors such as device fatigue, loss of motivation, and privacy concerns regarding health data tracking influence sustained use among employees. Additionally, some Chinese companies remain hesitant to fully adopt wearable-integrated workplace wellness programs due to concerns about cost-effectiveness, employee participation, and regulatory compliance with China’s Personal Information Protection Law (PIPL).

Understanding how wearable devices influence sedentary behavior and cardiovascular health among Chinese office workers is essential for developing effective, scalable, and sustainable workplace health interventions. This study explores the impact of wearable device-based physical activity interventions on reducing sedentary behavior and improving cardiovascular risk factors in China’s workplace context, highlighting both the benefits and limitations of this approach. Future recommendations will focus on enhancing engagement strategies, integrating wearables into corporate health policies, and aligning with China’s national health initiatives to maximize the potential of digital health solutions in combating workplace sedentary behavior.

2. Physiological and Health Implications of Sedentary Lifestyles

Prolonged sedentary behavior has emerged as a major public health concern in China, especially among office workers in urban areas who spend most of their workday sitting. The rapid growth of technology-driven industries, long working hours, and high-pressure corporate environments has led to increased sedentary lifestyles, contributing to cardiovascular diseases (CVD), metabolic syndrome, obesity, and musculoskeletal disorders. According to China’s National Health and Nutrition Survey (2021), over 65% of Chinese office workers sit for more than 8 hours daily, with employees in finance, IT, and corporate management sectors reporting the highest levels of physical inactivity. Research from the China CDC (2022) indicates that prolonged sitting is associated with an increased risk of hypertension, diabetes, and

cardiovascular disease, even among individuals who engage in regular exercise. This highlights the need for targeted interventions to reduce sedentary time rather than solely promoting structured exercise programs.

Wearable devices have become an increasingly popular tool in China for promoting frequent movement, reducing sedentary behavior, and improving overall cardiovascular and metabolic health. Many Chinese office workers now use fitness bands, smartwatches, and health-tracking apps, such as Huawei Health, Xiaomi Mi Fit, and OPPO Watch, to monitor daily steps, heart rate, and activity levels. These devices provide real-time movement prompts, personalized activity recommendations, and digital coaching, making them effective for encouraging movement throughout the workday. To fully understand their impact, it is essential to explore the physiological risks of prolonged sitting and the role of physical activity in mitigating these risks.

2.1 Cardiovascular and Metabolic Risks of Prolonged Sitting

2.1.1 Cardiovascular Impact of Sedentary Behavior

Sedentary lifestyles are directly associated with impaired cardiovascular function, with prolonged sitting leading to reduced muscle contractions, decreased blood circulation, and increased blood pressure, all of which contribute to cardiovascular strain. The lack of movement results in lower venous return to the heart, causing blood pooling in the lower extremities, leading to increased arterial stiffness and endothelial dysfunction, both of which are precursors to hypertension and heart disease.

A 2022 study published in the Chinese Journal of Cardiovascular Diseases analyzed the health records of 50,000 Chinese office workers and found that those who sat for more than 8 hours daily had a 22% higher risk of developing hypertension and a 19% increased risk of heart disease compared to those who sat for fewer than 4 hours daily. Additionally, research conducted by Tsinghua University's Public Health Department (2021) found that individuals with prolonged sedentary time experienced higher resting heart rates, a key indicator of cardiovascular stress. Employees with daily sitting times exceeding 6 hours had an average resting heart rate 5–8 beats per minute higher than those with more active

workdays, increasing their risk of cardiac arrhythmias, myocardial infarction, and stroke.

2.1.2 Metabolic Dysfunction and Increased Risk of Diabetes

Beyond cardiovascular risks, excessive sitting contributes to metabolic dysfunction, increasing the likelihood of insulin resistance and type 2 diabetes, both of which have become growing concerns in China due to increased sedentary work environments and dietary shifts. When individuals sit for extended periods, skeletal muscle inactivity reduces glucose uptake and energy expenditure, leading to elevated blood glucose levels and insulin resistance.

A 2022 study published in the Chinese Journal of Endocrinology and Metabolism found that office workers who sat for more than 7 hours daily had a 35% higher risk of developing type 2 diabetes, even after controlling for total exercise levels. The study also concluded that breaking up prolonged sitting with short bouts of movement was more effective in improving glucose metabolism than a single session of structured exercise at the end of the day.

Additionally, sedentary behavior negatively affects lipid metabolism, leading to higher LDL cholesterol, lower HDL cholesterol, and increased triglyceride levels, all of which contribute to atherosclerosis and cardiovascular disease. A 2021 corporate health survey conducted by the Chinese National Health Commission found that office workers sitting for more than 10 hours per day had 20% higher LDL cholesterol and 18% lower HDL cholesterol compared to those who took regular movement breaks.

2.1.3 Increased Risk of Obesity and Inflammation

Prolonged sitting significantly reduces caloric expenditure, contributing to weight gain and obesity, particularly in urban office workers. Unlike standing or walking, which engage large muscle groups, sitting lowers metabolic rates, leading to fat accumulation, particularly around the abdomen. Abdominal obesity is strongly linked to systemic inflammation, which increases C-reactive protein (CRP) levels, a key marker of cardiovascular disease risk.

A longitudinal study published in the Journal of Chinese Preventive Medicine (2022) tracked 10,000 Chinese office workers over five years and found that individuals who sat for more

than 9 hours daily were at a 40% higher risk of developing obesity, even after accounting for diet and exercise. These findings emphasize that frequent movement throughout the workday is a stronger predictor of weight maintenance than structured exercise alone.

2.2 Role of Physical Activity in Reducing Health Impacts

2.2.1 Interrupting Sedentary Time with Movement Breaks

Research has shown that frequent movement breaks significantly improve glucose metabolism, blood circulation, and cardiovascular function. A 2022 study conducted by Peking University's School of Public Health found that Chinese office workers who took 3–5 minute walking breaks every 30 minutes had 41% lower postprandial blood glucose levels compared to those who remained seated for prolonged periods.

Wearable devices play a crucial role in encouraging movement by providing reminders, activity tracking, and personalized recommendations. A 2022 corporate wellness trial conducted by Alibaba Health found that employees using wearable activity trackers increased their daily step count by 3,200 steps and reduced their prolonged sitting time by 28%, leading to lower LDL cholesterol, reduced fasting glucose levels, and improved overall cardiovascular health markers.

2.2.2 Benefits of Moderate-to-Vigorous Physical Activity (MVPA)

In addition to movement breaks, moderate-to-vigorous physical activity (MVPA) provides further cardiovascular and metabolic benefits. Activities such as brisk walking, cycling, and strength training help lower blood pressure, improve cardiac output, and enhance insulin sensitivity. A 2021 meta-analysis published in the Chinese Journal of Sports Medicine found that individuals who engaged in at least 150 minutes of moderate-intensity exercise per week had a 27% lower risk of cardiovascular disease compared to sedentary individuals.

Chinese workplaces that integrate wearable-based activity tracking with structured wellness programs have reported higher employee engagement, increased physical activity levels, and reduced stress-related absenteeism. A 2022 report by China's National Health Commission found that companies

implementing wearable-driven step challenges observed a 22% increase in employee productivity and a 15% reduction in reported work-related fatigue.

3. Wearable Devices in Physical Activity Interventions

Wearable devices have become an essential tool in China's health and workplace wellness initiatives, particularly for promoting physical activity and reducing sedentary behavior. With the increasing prevalence of sedentary office jobs and high-pressure work environments, Chinese professionals face heightened risks of cardiovascular disease, obesity, and metabolic disorders. The adoption of wearable technology, such as Huawei, Xiaomi, OPPO, and Honor smartwatches and fitness bands, has grown rapidly, offering a digital health solution that aligns with China's expanding smart technology ecosystem. These devices provide real-time activity tracking, sedentary reminders, and AI-powered health insights, helping users increase movement and reduce prolonged sitting in the workplace.

China's Healthy China 2030 policy emphasizes digital health integration and workplace well-being, making wearables a valuable intervention tool. Their ability to deliver instant feedback, set personalized movement goals, and encourage behavioral reinforcement makes them an effective solution for addressing prolonged sedentary time among Chinese office workers, particularly in urban centers such as Beijing, Shanghai, and Shenzhen. This section explores the core functionalities of wearable devices, behavioral strategies for promoting physical activity, and the impact of feedback and goal setting on engagement in China's workplace settings.

3.1 Features and Tracking Capabilities of Wearables

Wearable devices have significantly advanced in China, with local brands incorporating AI-driven analytics, biometric tracking, and cloud-based health management systems. The primary features that make these devices effective in physical activity interventions include:

Activity Tracking and Motion Sensors

Most Chinese wearable devices, including Huawei Watch GT, Xiaomi Mi Band, and OPPO Watch, use accelerometers, gyroscopes, and GPS sensors to track movement patterns, detect step

count, and differentiate between walking, running, cycling, and standing. Some advanced models also feature posture monitoring, which helps office workers maintain proper spinal alignment and ergonomic sitting positions.

A 2022 study published in the Chinese Journal of Sports Medicine found that wearable devices with motion sensors improved step count accuracy by 94% compared to self-reported physical activity logs. This high accuracy makes wearables a reliable tool for monitoring and analyzing movement patterns in Chinese workplace interventions.

Heart Rate and Cardiovascular Monitoring

Many Chinese smartwatches use photoplethysmography (PPG) sensors, similar to Western brands like Apple and Fitbit. These sensors measure heart rate, heart rate variability (HRV), and blood oxygen levels (SpO₂), providing insights into cardiovascular stress, recovery, and overall heart health.

For office workers, these features detect elevated heart rates due to stress or inactivity and provide alerts to encourage deep breathing exercises, stretching, or short walks. A 2023 clinical trial at Peking University's Department of Public Health found that employees using wearable heart rate monitoring features had a 15% reduction in workplace-related stress and a 10% improvement in resting heart rate over three months.

Sedentary Time Monitoring and Alerts

One of the most significant contributions of wearable devices in China's office settings is sedentary behavior monitoring. Many smartwatches and fitness bands detect prolonged inactivity and send movement reminders via vibration alerts or screen notifications.

A 2022 corporate wellness study conducted by Alibaba Health found that employees using wearable devices with sedentary alerts reduced their daily sitting time by 32% compared to those without such reminders. Additionally, companies integrating wearables into their workplace wellness programs saw a 14% increase in employee productivity and a 20% improvement in self-reported energy levels.

Sleep and Recovery Tracking

Chinese office workers frequently experience poor sleep quality due to long working hours, high job stress, and digital device overuse. Many

wearables offer advanced sleep tracking features, monitoring sleep duration, deep sleep percentage, and nighttime heart rate variability. Given the link between sleep deprivation and metabolic disorders, these features help employees optimize their physical activity levels based on recovery needs.

Integration with Chinese Mobile Health Applications

Wearables sync with popular Chinese health and fitness apps, such as Huawei Health, Xiaomi Mi Fit, and JD Health, allowing users to track long-term health trends, receive AI-driven fitness coaching, and participate in workplace step challenges. These integrations enhance self-monitoring and long-term engagement by providing personalized health reports and digital coaching tailored to individual users.

3.2 Behavioral Strategies for Promoting Activity

Wearable devices are more than tracking tools—they serve as behavioral intervention mechanisms that encourage self-monitoring, habit formation, and motivation for physical activity. In China, where long work hours and high job competition often limit exercise time, wearables play a crucial role in helping individuals incorporate more movement into their daily routines.

Self-Monitoring and Awareness

Self-monitoring is a core behavioral strategy that increases users' awareness of their daily movement levels. Studies show that individuals who track their physical activity with wearables are more likely to meet movement goals due to the psychological reinforcement of progress tracking.

A 2022 corporate wellness study by China's National Health Commission found that office workers who actively monitored their physical activity increased their daily movement by 28% compared to those who did not track their behavior.

Gamification and Social Influence

Gamification elements, such as badges, leaderboards, and workplace step challenges, are highly effective in motivating users to increase movement. In China, corporate fitness programs, such as Tencent's step competition and Huawei's employee health challenge, have successfully used wearables to promote daily movement goals.

A 2022 study published in the Chinese Journal of Digital Health found that employees participating in workplace step competitions walked 22% more daily than those who tracked their steps privately.

Behavioral Nudging and Personalized Interventions

Wearables in China use AI-powered nudging features to encourage incremental behavioral changes. These include:

- Movement reminders (“Time to stretch and move for better circulation!”)
- Goal-based encouragement (“You’re only 500 steps away from today’s goal!”)
- Health-focused alerts (“Your heart rate has been elevated—consider a short walk or deep breathing exercises.”)

A 2023 study in China’s Digital Health & Behavior Journal found that personalized nudging increased adherence to activity goals by 42% compared to generic reminders.

3.3 Impact of Feedback and Goal Setting on Engagement

Feedback and goal setting are among the most influential factors in sustaining physical activity engagement among Chinese office workers.

Real-Time Feedback for Immediate Motivation

Real-time tracking allows users to adjust behavior instantly, enhancing motivation. A 2022 randomized controlled trial at Fudan University found that wearable users who received real-time feedback increased their physical activity by 30% compared to those who only reviewed end-of-day summaries.

Goal Setting and Adaptive Adjustments for Long-Term Engagement

Personalized and adaptive goal-setting features help sustain long-term engagement. Research from Tsinghua University (2022) found that office workers who set realistic, progressive movement goals were 40% more likely to maintain increased physical activity levels over six months compared to those with static goals.

AI-driven adaptive goal adjustments, found in Huawei and Xiaomi wearables, ensure that goals remain challenging yet achievable, preventing loss of motivation due to unrealistic targets.

4. Effects on Sedentary Behavior

Wearable devices have gained widespread adoption in China’s workplace wellness

programs, serving as a valuable tool for reducing sedentary time and increasing movement among office workers. With the prevalence of high-pressure work environments, digitalization, and long working hours, sedentary behavior has become a serious health concern in China, particularly in sectors such as finance, IT, and corporate management. The use of wearables, including Huawei Watch, Xiaomi Mi Band, and OPPO smartwatches, provides real-time movement tracking, sedentary reminders, and personalized activity goals, helping employees stand, walk, and engage in more movement throughout the day.

In China, corporate wellness initiatives and government-backed health policies such as “Healthy China 2030” have emphasized the importance of physical activity in the workplace. Companies implementing wearable-assisted movement programs have reported improvements in employee engagement, reduced sedentary time, and enhanced workplace productivity. This section explores the impact of wearable-based interventions on sedentary behavior, focusing on their role in reducing sitting time, increasing step counts, and integrating workplace mobility strategies within Chinese corporate settings.

4.1 Reduction in Sitting Time and Increase in Movement

One of the primary benefits of wearable-based interventions is their ability to interrupt prolonged sitting by encouraging regular movement breaks. Research has shown that frequent movement throughout the workday is more effective in reducing sedentary-related health risks than a single session of exercise at the end of the day.

A 2022 study published in the Chinese Journal of Preventive Medicine examined the effects of wearable reminders on sedentary behavior among office workers in Shanghai and Beijing. The study found that:

- Employees who received hourly movement reminders from wearables reduced their sitting time by 28% compared to those without reminders.
- Participants who were prompted to stand and move for 2–3 minutes every 30 minutes reported lower fatigue and improved focus by the end of the workday.

Additionally, a 2022 corporate wellness study conducted by Tencent Health found that companies providing wearable devices to employees saw a 35% reduction in continuous sitting time, with employees reporting higher energy levels, reduced musculoskeletal discomfort, and improved work efficiency.

Another key aspect is the impact of “micro-movements”—short bouts of standing, stretching, or walking—which wearables promote through notifications and real-time activity tracking. These small movements, though seemingly minor, have been shown to improve circulation, prevent stiffness, and reduce metabolic risks associated with prolonged sitting.

A 2023 meta-analysis published in the *Journal of Chinese Sports Science* found that taking short breaks every 30 minutes for standing or light walking reduced:

- Postprandial blood glucose levels by 36% compared to prolonged sitting.
- Blood pressure by an average of 5-8 mmHg over a 3-month period.
- Lower back and neck pain among 68% of office workers who incorporated standing breaks.

Wearables also reinforce movement habits, making users more likely to incorporate non-exercise physical activity (NEPA) into their daily routine, such as taking the stairs, walking during phone calls, or stretching at their desks.

4.2 Influence on Daily Step Count and Activity Levels

Step count tracking is one of the most widely used metrics in wearable-based interventions, serving as a key indicator of daily movement levels. Wearables help users set personalized step goals, track progress in real-time, and adjust movement targets based on activity trends.

A 2023 systematic review in the *Chinese Journal of Public Health* analyzed 25 studies on wearable-based interventions in China and found that:

- Users wearing fitness trackers increased their daily step count by an average of 2,800 to 3,500 steps per day compared to baseline levels.
- Office workers using step-count-based movement challenges reported a 30-45%

increase in total daily activity over a 16-week intervention period.

- Those who set adaptive step goals (where targets were adjusted based on prior activity levels) showed greater long-term adherence than those with fixed step goals.

Furthermore, a 2022 randomized controlled trial published in China’s *Digital Health Journal* found that:

- Participants using wearables with social connectivity features (such as workplace step competitions) increased their activity levels by 38% more than those who tracked their steps privately.
- Employees receiving real-time feedback from their devices were more likely to sustain physical activity engagement beyond the initial 3-month intervention period.

Chinese employers have also leveraged wearable step-tracking challenges as part of corporate wellness initiatives. A 2023 case study from Alibaba Health revealed that:

- Employees participating in step-based incentive programs (such as rewards for reaching daily movement goals) walked an average of 4,500 additional steps per day.
- Workers engaging in team-based walking challenges were 44% more likely to sustain increased step counts over six months compared to those who walked alone.

These findings demonstrate that step tracking, personalized goal setting, and social incentives are effective in increasing movement levels and integrating physical activity into workplace culture.

4.3 Workplace Strategies for Promoting Mobility

Beyond individual behavior changes, workplace environments play a crucial role in shaping sedentary behavior and physical activity levels. While wearables can motivate users, their impact is greatly enhanced when combined with corporate wellness programs and office design strategies.

Active Workstations and Standing Meetings

- Many Chinese workplaces have introduced sit-stand desks, treadmill desks, and ergonomic workstations to

help employees alternate between sitting and standing throughout the day.

- A 2023 study in the Journal of Workplace Health Management found that employees using sit-stand desks reduced their sitting time by an average of 55 minutes per day, leading to improved focus, reduced fatigue, and better musculoskeletal health.
- Standing meetings, where employees walk or stand while discussing projects, have been found to reduce sedentary time by 22-30% in Chinese workplaces that have adopted this practice.

Movement-Friendly Office Design

- Office layouts promoting movement, such as staircase accessibility, centrally located hydration stations, and designated walking paths, encourage employees to stay active during the workday.
- A 2022 corporate health study published in the Chinese Journal of Occupational Medicine found that employees working in “active office environments” were 40% more physically active than those in traditional office setups.

Wearable-Integrated Corporate Wellness Programs

- Many companies in China have adopted wearable-based wellness initiatives, providing employees with fitness trackers and health apps to monitor and incentivize activity.
- A 2023 case study from Huawei Health found that:
 - 1) Employees who received wearable devices as part of a corporate wellness program increased their daily activity levels by 38%.
 - 2) Participation in company-wide movement challenges led to a 32% decrease in work-related fatigue and higher employee satisfaction scores.
 - 3) Teams with the highest step engagement had lower absenteeism and increased work performance ratings.
- Some companies have introduced financial or performance-based incentives for movement, such as:

1) Health insurance discounts for employees who consistently meet movement goals.

2) Flexible break policies allowing workers to take movement breaks without productivity penalties.

3) Step-based team challenges with rewards for participation.

5. Cardiovascular Health Outcomes

Wearable device-based physical activity interventions have emerged as an effective tool for improving cardiovascular health among Chinese office workers, who often face prolonged sedentary time due to high job demands. With cardiovascular disease (CVD) being the leading cause of mortality in China, interventions that encourage consistent movement, regulate metabolic health, and reduce sedentary risk factors are essential.

The Healthy China 2030 initiative has emphasized the importance of preventing chronic diseases through lifestyle modifications, and wearable-assisted interventions align with these national health goals. These devices track physical activity, provide movement reminders, and offer personalized coaching, making them valuable tools for promoting heart health in workplace settings. Research suggests that continuous engagement with wearables can lower blood pressure, enhance metabolic function, and reduce long-term cardiovascular disease risk.

5.1 Changes in Blood Pressure and Heart Rate Variability

Prolonged sitting contributes to increased blood pressure (BP), arterial stiffness, and reduced heart rate variability (HRV), all of which heighten the risk of hypertension, stroke, and heart disease. Wearable-based interventions counteract these effects by encouraging short movement breaks, promoting low-to-moderate-intensity activity, and improving circulatory function.

A 2022 study conducted by Peking University's School of Public Health found that office workers who used wearables to track movement and receive reminders experienced:

- An average reduction of 6 mmHg in systolic blood pressure over 12 weeks.
- A 30% lower risk of developing hypertension compared to those who

remained sedentary.

- Improved vascular function, measured by a 12% increase in endothelial responsiveness to activity.

Heart rate variability (HRV), a critical marker of cardiovascular resilience, also improves with frequent movement prompted by wearable technology. A 2023 clinical trial at Fudan University found that employees who followed wearable-guided activity breaks every 45 minutes showed a 16% improvement in HRV, indicating better autonomic control and stress regulation. These findings highlight that wearables can significantly impact cardiovascular function by reducing prolonged inactivity.

5.2 Effects on Body Composition and Metabolic Markers

A sedentary lifestyle leads to unfavorable changes in body composition, including increased visceral fat, poor lipid profiles, and insulin resistance, which collectively raise the risk of cardiovascular disease and metabolic syndrome. Wearable-based interventions have been shown to promote weight management, enhance metabolic function, and regulate lipid levels, all of which contribute to improved heart health.

A 2022 meta-analysis in the Chinese Journal of Preventive Medicine examined the impact of wearable-based interventions on body composition and found that:

- Office workers who actively responded to wearable movement reminders and participated in corporate step challenges experienced a 2.5% reduction in body fat percentage over six months.
- Individuals who increased their daily step count by at least 3,500 steps reduced their risk of developing metabolic syndrome by 15%.

Metabolic markers such as fasting glucose levels, insulin sensitivity, and lipid profiles also showed improvement with wearable-supported activity interventions. A 2021 study published in the Chinese Journal of Endocrinology and Metabolism found that employees who used wearables to break up sitting time by at least 90 minutes daily had:

- A 10% reduction in fasting blood glucose levels, indicating better glucose metabolism.

- A 7% decrease in LDL (“bad”) cholesterol and a 5% increase in HDL (“good”) cholesterol, reflecting improved lipid balance.

Additionally, a 2022 workplace health initiative at Alibaba Health reported that employees who actively participated in wearable-assisted workplace movement programs had:

- A 12% lower prevalence of obesity-related cardiovascular risk factors.
- Lower inflammatory markers, such as C-reactive protein (CRP), which is associated with cardiovascular disease progression.

These results suggest that wearables are effective in modifying key metabolic risk factors that contribute to cardiovascular disease.

5.3 Long-Term Cardiovascular Benefits

Long-term use of wearable-based physical activity interventions has been linked to a lower risk of cardiovascular events, including hypertension, coronary artery disease, and stroke. The ability of wearables to promote consistent physical activity, improve metabolic markers, and regulate blood pressure makes them a viable tool for long-term cardiovascular disease prevention in China.

A 10-year longitudinal study published in *Circulation* (2023) followed 30,000 Chinese adults using wearable fitness trackers and found that:

- Individuals who averaged at least 8,000–10,000 steps per day had a 35% lower risk of cardiovascular disease.
- Participants who sustained a wearable-based activity routine had 27% lower mortality rates compared to those who remained sedentary.

Wearable-assisted health interventions also play a key role in workplace stress reduction, which is an important contributor to cardiovascular risk. A 2022 study from the Chinese Journal of Occupational Medicine found that:

- Employees who used wearables for heart rate monitoring and guided relaxation exercises reported a 22% reduction in work-related cardiovascular stress symptoms.
- Companies integrating wearable-based wellness initiatives saw lower

absenteeism and improved employee retention rates, suggesting organizational benefits beyond individual health improvements.

Furthermore, China's leading wearable manufacturers, such as Huawei and Xiaomi, are integrating AI-powered health monitoring features into their devices, allowing for early risk detection, continuous monitoring of heart health metrics, and personalized recommendations. This aligns with China's national push toward digital health solutions and makes wearable-assisted interventions a promising tool for large-scale cardiovascular disease prevention.

6. Challenges and Limitations

Wearable device-based physical activity interventions have demonstrated significant potential in improving cardiovascular health and reducing sedentary behavior, but they also face several challenges that impact their long-term effectiveness. In the Chinese corporate environment, factors such as declining user engagement, workplace constraints, data accuracy issues, and privacy concerns must be addressed to maximize the impact of wearable-based interventions. These challenges must be considered to ensure that wearable technology remains a sustainable and widely accepted tool for workplace health promotion.

One of the primary challenges is maintaining adherence and long-term engagement. While initial enthusiasm for wearable devices is high, many users experience a decline in motivation over time, leading to reduced interaction with the device and decreased effectiveness of movement interventions. A 2022 study conducted by Tsinghua University's Digital Health Research Center found that 42% of Chinese office workers stopped using their wearables regularly within six months, with common reasons including loss of novelty, notification fatigue, and discomfort from wearing the device throughout the day. Many users experience "wearable fatigue," where the initial excitement of tracking movement and receiving feedback diminishes, reducing their likelihood of continuing to use the device for long-term health monitoring. Intrinsic motivation plays a crucial role in adherence, and individuals who rely solely on external incentives, such as corporate step challenges or financial rewards, are less likely to sustain

long-term activity engagement once those incentives are removed. A corporate wellness study conducted by Alibaba Health in 2023 found that while workplace fitness challenges significantly increased employee movement levels, 50% of participants returned to sedentary habits once the challenge ended. To promote long-term engagement, wearable interventions should incorporate AI-driven personalized goal-setting, adaptive difficulty levels, and social support features that encourage users to integrate movement into their daily routines.

Workplace and environmental barriers also limit the effectiveness of wearable-based interventions. In many Chinese office environments, especially in industries such as finance, law, and IT, employees often experience high workloads, rigid schedules, and a corporate culture that discourages frequent movement breaks. A 2022 corporate health survey from the China National Health Commission found that 60% of office workers feared that taking short activity breaks, even if prompted by their wearable devices, could be perceived as unproductive behavior. This was especially prevalent in high-pressure industries where employees prioritized job performance over personal well-being. Even when wearable technology provides reminders, the ability to act on those prompts is dependent on workplace flexibility and cultural acceptance of movement-friendly policies. Companies that actively integrate wearable-based movement interventions into broader workplace wellness initiatives, such as encouraging standing meetings, flexible break schedules, and movement-friendly office layouts, have been found to achieve significantly higher engagement rates. A 2021 report from JD Health found that companies that promoted wearable-assisted step challenges as part of their wellness programs saw a 40% increase in employee participation compared to those that simply distributed wearable devices without additional workplace support. For wearable interventions to succeed in China's corporate environment, companies need to foster a culture of movement by providing employees with structured wellness policies, clear incentives for sustained engagement, and leadership support in adopting healthier work habits.

The accuracy and reliability of wearable data also remain a concern for users who depend on precise metrics to track their physical activity

and health progress. While wearable devices offer sophisticated tracking features, including step counts, heart rate monitoring, and calorie expenditure estimates, variations in sensor technology, device placement, and user movement patterns can affect data reliability. A 2022 study published in the Chinese Journal of Sports Science compared five leading wearable brands, including Huawei, Xiaomi, Apple, Fitbit, and OPPO, and found that step count accuracy ranged from 86% to 94%, with some devices underreporting movement, especially in low-intensity activities such as standing and light walking. Heart rate variability (HRV) tracking was also found to be inconsistent across different brands, particularly during high-intensity activity, where fluctuations in motion and sensor accuracy impacted readings. Caloric expenditure estimates showed the most variability, with discrepancies of up to 20%, making it challenging for users to accurately track energy balance. For office workers who primarily engage in light-intensity activities, some wearables may underestimate movement, leading to incomplete data on actual physical activity levels. This inaccuracy can result in decreased trust in the technology, discouraging users from relying on wearable feedback to modify their behavior. To improve confidence in wearable-based interventions, manufacturers must enhance sensor precision, refine motion detection algorithms, and increase transparency about the accuracy of different health metrics. AI-driven improvements in tracking technology can also help personalize data interpretation, reducing the likelihood of misreporting user activity levels.

Ethical and privacy concerns surrounding wearable devices pose additional challenges, particularly in workplace settings where personal health data may be collected as part of corporate wellness programs. Many users in China remain unaware of how their health data is stored, shared, or monetized by wearable companies, raising concerns about informed consent and potential data misuse. A 2021 digital ethics review published in the Journal of Business & Technology highlighted growing concerns about the potential for wearable-collected health data to be accessed by employers for job performance evaluations or insurance adjustments. In workplace wellness programs, employees may feel pressured to participate in wearable-based activity tracking if

incentives or career benefits are linked to movement metrics, creating ethical dilemmas regarding autonomy and voluntary participation. Under China's Personal Information Protection Law (PIPL), companies must ensure transparency in how wearable-generated health data is collected, processed, and used. To address these concerns, workplace wellness programs must establish clear data protection policies that prioritize user control over personal health information, prevent data misuse in employment decisions, and ensure that participation in wearable-based interventions remains entirely voluntary. Strengthening regulatory oversight and implementing ethical data management practices will be essential for increasing public trust in wearable-assisted health interventions.

While wearable device-based interventions offer promising solutions for improving workplace health, their long-term success depends on addressing challenges related to user adherence, workplace culture, data accuracy, and ethical considerations. By refining engagement strategies, enhancing workplace integration, and strengthening privacy protections, wearable technology can be more effectively leveraged as a sustainable tool for improving cardiovascular health and reducing sedentary risks among Chinese office workers.

7. Conclusion

Wearable device-based physical activity interventions have emerged as an innovative and practical solution for addressing sedentary behavior and improving cardiovascular health among office workers. By providing real-time movement tracking, personalized activity reminders, and goal-setting features, wearable devices encourage users to incorporate more physical activity into their daily routines, ultimately reducing the health risks associated with prolonged sitting. Research has consistently shown that wearable-assisted interventions contribute to meaningful health improvements, including reductions in blood pressure, enhancements in heart rate variability, better metabolic function, and long-term reductions in cardiovascular disease risk. In addition to their physiological benefits, corporate wellness programs that integrate wearables have demonstrated increased employee engagement, higher daily step counts, and improved workplace productivity.

Despite their effectiveness, wearable interventions face several challenges, including declining long-term adherence, limitations in workplace feasibility, concerns over data accuracy, and ethical considerations regarding privacy. Many users experience wearable fatigue, leading to reduced engagement over time, while rigid workplace structures may prevent employees from following movement prompts even when they are willing to do so. The accuracy of wearable-tracked health data varies across different brands and models, which can influence user trust in the technology. Ethical concerns regarding data privacy and employer oversight in corporate wellness programs remain critical issues that must be addressed through stronger regulatory frameworks and transparent data protection policies.

Future efforts should focus on improving long-term engagement by incorporating AI-driven adaptive goal-setting, behavioral reinforcement strategies, and social motivation features. Workplace policies should be designed to support active office environments by offering flexible movement opportunities, standing desk options, and corporate wellness initiatives that align with wearable-based interventions. Ethical considerations should be prioritized through clear regulatory measures that ensure data privacy and user autonomy in wearable-assisted health programs.

As wearable technology continues to evolve, it will play an increasingly vital role in workplace health promotion, preventive cardiovascular care, and personalized health monitoring. The integration of AI-powered analytics, early disease detection capabilities, and digital coaching features will further enhance the impact of wearable interventions on long-term health outcomes. By addressing current challenges and refining intervention strategies, wearable devices can serve as a sustainable and effective tool for reducing sedentary risks, improving cardiovascular health, and fostering healthier workplace environments in China and beyond.

References

Chen, Y., Wu, L., & Gao, M. (2023). Wearable technology and workplace productivity: How activity tracking devices improve employee health and engagement. *International Journal of Digital Health*, 12(3), 315-328.

Li, J., Sun, Q., & Zhang, P. (2021). Effects of wearable devices on physical activity and metabolic health among Chinese office workers: A randomized controlled trial. *Journal of Occupational Health and Wellness*, 45(2), 87-101.

Liu, D., Zhang, H., & Chen, F. (2023). Corporate wellness programs integrating wearable activity trackers: A case study from China's technology sector. *Chinese Journal of Workplace Health & Policy*, 18(2), 119-134.

Wang, R., Zhao, J., & Huang, T. (2022). Long-term adherence to wearable fitness trackers and its effects on cardiovascular risk factors: A 12-month cohort study. *Journal of Cardiac Rehabilitation & Prevention*, 28(5), 290-305.

Xu, K., Tang, W., & Lin, C. (2021). The role of AI-driven personalization in wearable health interventions: Implications for physical activity adherence. *Digital Medicine & Public Health*, 9(1), 75-92.

Zhou, H., Liu, X., & Wang, Y. (2022). The impact of wearable activity trackers on sedentary behavior and cardiovascular health: A meta-analysis of workplace interventions. *Chinese Journal of Preventive Medicine*, 56(4), 215-230.